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# Title page

**Title:**

Trends in paediatric laboratory-diagnosed onychomycosis between 2006 - 2014 in the South West of England.

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## Abstract

This is the largest study of laboratory-diagnosed onychomycosis in England for those aged  $\leq 16$  years. The commonest (91.5%) cultured organism in this population was *Trichophyton rubrum*. *Candida* species were only isolated from finger nails and the majority were from children under the age of 5 years. Continued analysis of fungal pathogens is vital to identify changing trends.

## Background

There are few reports studying onychomycosis in children, with a reported prevalence of 0.2% - 2.6%(1).

## Aim

The aim was to analyse epidemiological trends of laboratory-diagnosed onychomycosis from the paediatric population in the South West of England between March 2006 – October 2014.

## Methods

Data was collected from computerised records at the Public Health England Mycology Reference Laboratory and included nail specimens received from the Bristol and Bath catchment area, from patients aged 16 years of age or younger. We recorded the patients' age, gender, microscopy and culture results and site of specimen. Statistical analysis was carried out in STATA 13®.

## Results

A total of 1,434 specimens were received. The mean age of patients was 9.6 years (95% CI 9.3, 9.8), Table 1.

There were significant differences in the proportion of positive results from different age groups: in 0-5 year olds, positive microscopy was seen in 34% and positive culture in 24%, whilst in 6-10 year olds the results were 64% and 47% respectively and in 11-16 year olds 50% and 35% respectively ( $p < 0.001$ ).

There were statistically more culture-positive results from males than females (38% vs 33%,  $p = 0.038$ ). There was some evidence of this for the microscopy-positive results (males 56% vs females 44%,  $p = 0.054$ ). Thirty-five percent (501/1434) of samples were both microscopy and culture positive.

Eighty nine percent (948/1070) of specimens were from toe nails. There were significantly more finger nail specimens received from children under 5 years of age compared to the older age groups (16% vs 9.5%,  $p = 0.027$ ).

Eight different organisms were cultured. The commonest was *Trichophyton rubrum* (91.5%), Table 2. The percentage of *Candida* species grown from children aged 0-5 years (13%) was significantly higher than the older age groups

(3%) ( $p < 0.001$ ); 9/15 were from unspecified sites and the remaining 6/15 from fingernails. *Fusarium* was only cultured in those over the age of 11 years.

## Discussion

This is the largest study to date looking at trends in paediatric laboratory-diagnosed onychomycosis in England.

Smaller European studies and one from Korea found *T. rubrum* to be the most prevalent organism in their paediatric population (1-4). Although *Candida* was the most commonly isolated organism from finger nail specimens in our population, one cannot determine if it represents true nail plate infection or colonisation of onycholysis. *Candida* was nevertheless exclusively isolated from fingernails and the majority was from children under the age of 5 years. This finding has been reported in Poland (5). We postulate thumb sucking to be a contributory factor.

Onychomycosis is more common with increasing age due to slower nail growth, larger contact surface increasing the risk of trauma and fungal colonisation, more frequent exposure to fungi in public spaces and a higher prevalence of tinea pedis (1). It is therefore surprising that onychomycosis was most prevalent in the 6-10 years of age group and is different to that found in other studies (1,2).

Although this is the first UK study of its type, it is limited by its retrospective nature and lack of clinical case information. Performing such studies is important for the continued analysis of fungal pathogens. The British Association of Dermatologists' guidelines (6) recognise that the dominant aetiological agents are *T. rubrum*, *T. mentagrophytes* and *Candida*, and as such recommend the use of terbinafine, itraconazole and fluconazole. Griseofulvin is still the only licensed systemic antifungal drug for children, however it is no longer first line treatment due to the long treatment duration and low efficacy. The azoles are advocated in onychomycosis caused by *Candida* species. This study therefore reinforces the recommendations set out in the UK guidelines.

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**TABLE 1.** Patient characteristics.

<b>Variable</b>	<b>Number of patients (%)</b>
Gender	
Male	768 (54%)
Female	664 (46%)
Unknown	2 (0.1%)
Age (years), Median (IQR)	10.4 (5.9, 13.7)
Season	
Winter	739 (52%)
Summer	695 (48%)
Site	
Finger	122 (9%)
Toe	948 (66%)
Unspecified	364 (25%)
Microscopy	
No Fungus seen	721 (50%)
Fungal elements seen	711 (50%)
Yeast seen	2 (0.1%)
Culture	
No fungus isolated	919 (64%)
Culture positive	515 (36%)

**TABLE 2.** Species cultured according to site of nail infection. These results exclude the specimens from unspecified sites. (% out of the total, 377)

Organism	Site of specimen		Total
	Finger	Toe	
Dermatophyte mould			
<i>Trichophyton rubrum</i>	5 (1.33%)	343 (90.98%)	348 (92.31%)
<i>Trichophyton interdigitale</i>	1 (0.27%)	14 (3.71%)	15 (3.98%)
<i>Trichophyton violaceum</i>	1 (0.27%)	0 (0.00%)	1 (0.27%)
Non-dermatophyte mould			
<i>Fusarium</i> sp.	1 (0.27%)	5 (1.33%)	6 (1.59%)
<i>Scopulariopsis brevicaulis</i>	0 (0.00%)	1 (0.27%)	1 (0.27%)
Yeasts			
<i>Candida</i> sp.	6 (1.59%)	0 (0.00%)	6 (1.59%)
<b>Total</b>	<b>14 (3.71%)</b>	<b>363 (96.29%)</b>	<b>377 (100%)</b>